

CHAPTER 2

INSPECTION AND TESTS

Section I - PERFORMANCE

2-1. Determining equipment condition.

The ability of equipment to perform its function, or to continue its function for its normal life cycle, must be determined if the distribution system is to operate dependably and economically. The condition of equipment can be determined by two methods: inspection and tests. Such things as broken insulators or oil leaks can easily be determined by inspections, but other details such as the condition of transformer oil or a trip setting for a circuit breaker can be determined only by tests. The scope of inspection and tests is dependent on the type and complexity of the equipment, and the results desired. Inspections are normally visual, but hearing, touching, and smelling can also indicate problem areas. Tests can be electrical, physical, or chemical, or combinations of these. The selection of the test to be made may be at least partially determined by the availability of test equipment and of personnel capable of using it.

2-2. Reasons for inspections and tests.

Inspections and tests are performed for several reasons.

a. Preventive maintenance. This includes routine testing of operating equipment and periodic testing of nonoperating components to anticipate and correct possible equipment failure before it occurs.

b. Maintenance proof testing. This is testing to ensure that maintenance/repair was done properly. This should be done when maintenance and/or repair are complete, and to show whether the equipment is operable and properly connected.

2-3. Associated test guidance and records.

Tests are ordinarily used in the field to determine the condition of various elements of an electrical power-distribution system. The data obtained in these tests provide information that is used to determine whether any corrective maintenance or replacement is necessary or desirable. The ability of the element to continue to perform its design function adequately can be ascertained. Also the gradual deterioration of the equipment over its service life can be charted. Records must include factory test data provided with shop drawing submittals, acceptance testing data, and each routine maintenance test, so that the history of the equipment may be

available for future reference. Records should be maintained to indicate what test data are required and what means are to be used to provide this data. Nondestructive maintenance tests can cause insulation breakdown with no warning. A plan for coping with this possibility should be included in the test procedures.

a. Qualifications of test operators. If a testing program is to provide meaningful information relative to the condition of the equipment under test, then the person evaluating the test data must be assured that the test was conducted in a proper manner and that all of the conditions that could affect the evaluation of the tests were considered and any pertinent factors reported. The test operator, therefore, must be thoroughly familiar with the test equipment used in the type of test to be performed, and also sufficiently experienced to be able to detect any equipment abnormalities or questionable data during the performance of the tests.

b. Test equipment. It is important to have the proper equipment for performing the required tests in any test program. In general, any test equipment used for the calibration of other equipment should have an accuracy at least twice the accuracy of the equipment under test. The test equipment should be maintained in good condition and should be used only by qualified test operators. All test equipment should be calibrated at regular intervals to ensure the validity of the data obtained. In order to get valid test results, it may be necessary to regulate the power input to the test equipment for proper waveform and frequency and to eliminate voltage surges.

c. Use of forms. To provide optimum benefits, record all testing data and maintenance actions on test circuit diagrams and forms that are complete and comprehensive. Recording both test data and maintenance information on the same form is recommended. A storage and filing system should be set up for these forms that will provide efficient and rapid retrieval of information regarding previous testing and maintenance on a piece of equipment. A well-designed form will also serve as a guide or a checklist of inspection requirements. Samples of typical forms that can be used are included in NFPA 70B, appendix G.

Section II - REQUIREMENTS

2-4. Electric workers, instruments, and reports.

Tests of electrical equipment should be performed under the supervision of qualified electric workers. If in-house personnel are not available for these tests, the services of a qualified electrical testing agency may be used.

a. Testing agency qualifications. The testing agency should submit proof that it is a corporately independent testing organization which can function as an unbiased testing authority, professionally independent of the manufacturers, suppliers, and installers of equipment or systems evaluated by the testing firm. The testing agency should meet OSHA criteria for accreditation of testing laboratories, Title 29, Part 1910-7; or be a full member company of the InterNational Electrical Testing Association (NETA) and be regularly engaged in the testing of electrical equipment devices, installations, and systems. The lead technical agency member on-site should be currently certified by NETA or the National Institute for Certification in Engineering Technologies (NICET) in electrical power distribution system testing.

b. Test instrument calibrations. Instruments should have been calibrated within the last 12 months except that analog instruments should have been calibrated within the last 6 months. Calibration should provide the full-scale accuracy based on

the manufacturer's data, usually 1 percent for switchboard instruments and 0.25 percent for portable instruments. Dated calibration labels should be visible and up-to-date calibration records, instructions, and procedures should be maintained for each instrument which should have had a calibrating standard of higher accuracy than that of the test instrument.

c. Test reports. A dated test report should include, as a minimum, the following data:

- (1) Summary of project findings and recommendations, if required for additional work.
- (2) Description of equipment tested.
- (3) Description of test.
- (4) Test results.

2-5. Frequency of inspection.

The intervals given in this manual and/or by manufacturer's maintenance recommendations should be considered an initial interval for normal conditions. Intervals should be shortened where adverse conditions exist and may be lengthened only where experience under better-than-normal conditions show this can be done safely. The frequency of inspection may vary for similar equipment operating under different conditions. Critical equipment, heavily loaded apparatus, operator handled, and intermittently operated units are examples of different operating conditions.